REMARKS

Request for Continued Examination

Applicant respectfully requests continued examination of the above-indicated application as per 37 CFR 1.114.

Amendments to the Claims

Claim 1 is currently amended to incorporate all the limitations of the originally filed claims 2 and 4. Accordingly, claims 2-4 are canceled.

Claim 11 is currently amended to incorporate all the limitations of the originally filed claims 12 and 14. Accordingly, claims 12-14 are canceled.

Claims 22-27 are newly added, which are dependent upon the previously presented independent claim 21.

No new matter is introduced by such amendments.

Claim Rejections under 35 U.S.C. § 103(a) in view of Calafato et al (US6,133,718)

In the present Office Action, claims 1-3, 5-10, 11-13, 15-20 are rejected as being unpatentable over Calafato et al (US6,133,718) for various reasons. In order to overcome such rejections, claim 1 is currently amended to incorporate all the limitations of the originally filed claims 2 and 4, and claims 2-4 are accordingly canceled. Likewise, claim 11 is currently amended to incorporate all the limitations of the originally filed claims 12 and 14, and claims 12-14 are accordingly canceled. The patentability of the original claims 4 and 14, and thus the currently amended claims 1 and 11, will be accounted for in the following section.

As a result, if, in view of the following explanation, the combination of the limitations of original claims 2 and 4, and 12 and 14 are considered allowable, the

now pending claims 1, 5-10, 11, 15-20 should then be considered allowable. Withdrawal of the underlying rejection is respectfully requested.

Claim Rejection under 35 U.S.C. § 103(a) in view of Toumazou et al (1/25/06 IDS)

In the present Office Action, claims 4, 14, and 21 are rejected as being unpatentable over Toumazou et al (1/25/06 IDS citation 1). In asserting the rejection, the Examiner stated that "Toumazou et al discloses a second order temperature compensated reference voltage generator (Figure 5.16)" comprising all of the claim limitations "as recited by claims 4, 14, and 21 except for utilizing at least 3 signal generators." The Examiner further alleged that "[i]t would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the reference generator of Toumazou et al by utilizing at least 3 signal generators". In supporting his assertion, the Examiner cited a case law, In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980), which held that "where the general conditions of the claim are disclosed in the cited and applied prior art, discovering the optimum or workable value of a result effective variable involves only routine skill in the art". The Applicant respectfully disagrees. Particularly, the Applicant asserts that the Toumazou article mischaracterized the circuitry disclosed therein, which leads to the misunderstanding of the Examiner in the present Official Action. Consequently, the Applicant further asserts that In re Boesch actually serves as an inadequate analogy to the situation here in the examination of the present application.

Firstly, the Applicant asserts that the Toumazou article mischaracterized the nature of the structure and circuitry as disclosed in subsection 5.10.2, particularly in Figures 5.13-5.16, by stating that they represent a second-order compensated bandgap reference, while in fact they constitute no more than a conventional first-order temperature compensated bandgap reference structure. Indeed, throughout the entirety of subsection 5.10.2 of the Toumazou article, it is constantly represented that a second-order compensated bandgap reference is realized with two base-emitter voltages, and favorable performance can be resulted, e.g., 1.5ppm/K over a temperature range of 0-100℃ (page 159 or Figure 5.17) However, by presenting the following derivation and explanation, the Applicant will demonstrate, and

consequently prove that Toumazou actually teaches only a first-order temperature compensated bandgap reference circuit, just as those disclosed in the conventional art such as Calafato et al and the numerous references cited by the Examiner.

For the convenience of explanation, Figure 5.15 of the Toumazou article is reproduced herein as follows:

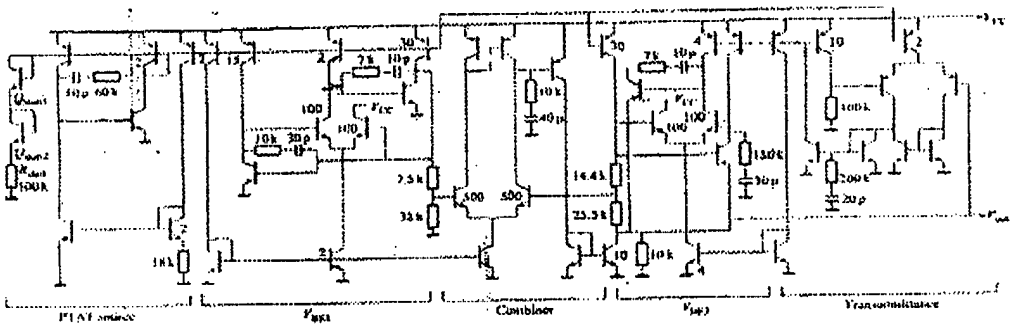

Figure 5.15. The total circuit diagram of the second-order compensated reference.

The Toumazou article characterized Figure 5.15 as "showing the basic structure implementing the summing node and scaling factors" (page 160, line 10-11), i.e., the so-called "second-order compensated bandgap reference" as is made clear by the title of the exact subsection. By analyzing the circuit structure as shown in Figure 5.15, the following equation can be derived:

$$A\left[\left(V_{BE2}\frac{R_{21}}{R_{21}+R_{22}}+Vo\right)-V_{BE1}\frac{R_{11}}{R_{11}+R_{12}}\right]=-Vo \qquad \text{(Equation 1)}$$

wherein V_{BE1} is the first base-emitter voltage, V_{BE2} is the second base-emitter voltage, R_{11} and R_{12} defines the first scaling factor, R_{21} and R_{22} defines the second scaling factor, Vo is the output voltage, and A represents the gain of the nuller, which is commonly viewed and implemented as an ideal voltage amplifier with its gain approaching infinity, or at least a great value. After rearranging Equation 1, the

following equation can be further resulted in:

$$Vo = \frac{A}{1+A}\left[V_{BE1}\frac{R_{11}}{R_{11}+R_{12}} - V_{BE2}\frac{R_{21}}{R_{21}+R_{22}}\right]$$

And since A is a value much greater than 1, the above equation can be further simplified as:

$$Vo \approx \left[V_{BE1}\frac{R_{11}}{R_{11}+R_{12}} - V_{BE2}\frac{R_{21}}{R_{21}+R_{22}}\right] \qquad \text{(Equation 2)}$$

That is to say, the output voltage Vo is a linear combination of the first base-emitter voltage V_{BE1} and the second base-emitter voltage V_{BE2}. Subsequently, it is noted that a base-emitter voltage, for example, one characterizing a bipolar device, can be represented by the following equation, as will be readily understood by one of ordinary skill in the art:

$$V_{BE} = \frac{kT}{q}\ln\left(\frac{Ic(T)}{Is(T)}+1\right)$$

Further, it is also common mathematical practice that a natural logarithm function can be expanded in the form of a Taylor expansion. Therefore, the first base-emitter voltage V_{BE1} and the second base-emitter voltage V_{BE2} can then be represented as follows:

$$V_{BE1} = a + b(T-T_0) + c(T-T_0)^2 + d(T-T_0)^3 + \ldots\ldots \qquad \text{(Equation 3)}$$

$$V_{BE2} = e + f(T-T_0) + g(T-T_0)^2 + h(T-T_0)^3 + \ldots\ldots \qquad \text{(Equation 4)}$$

Now by substituting V_{BE1} and V_{BE2} as represented by Equation 3 and Equation 4 into Equation 2, the following result will be rendered:

$$Vo = \left(\frac{R_{11}}{R_{11}+R_{12}}a - \frac{R_{21}}{R_{21}+R_{22}}e\right) + \left(\frac{R_{11}}{R_{11}+R_{12}}b - \frac{R_{21}}{R_{21}+R_{22}}f\right)(T-T_0)$$
$$+\left(\frac{R_{11}}{R_{11}+R_{12}}c - \frac{R_{21}}{R_{21}+R_{22}}g\right)(T-T_0)^2 + \left(\frac{R_{11}}{R_{11}+R_{12}}d - \frac{R_{21}}{R_{21}+R_{22}}h\right)(T-T_0)^3 + ...$$

The Applicant then asserts that it is the well known understanding of a skilled artisan that for a bandgap reference design to qualify as second-order temperature compensated, the coefficients of both the first order variable ($T-T_0$) and the second order variable $(T-T_0)^2$, i.e., $\left(\frac{R_{11}}{R_{11}+R_{12}}b - \frac{R_{21}}{R_{21}+R_{22}}f\right)$ and $\left(\frac{R_{11}}{R_{11}+R_{12}}c - \frac{R_{21}}{R_{21}+R_{22}}g\right)$ should both be designed of value 0. And as a matter of mathematical logics, except for those rare cases when the ratio of b/f equals that of c/g, there simply is no way to design the first and the second scaling factors, i.e., the value of R_{11}, R_{12}, R_{21}, and R_{22}, so that the above-listed two coefficients both equal to zero at the same time. In other words, it is mathematically necessitated that by merely introducing two adjustable factors into the equations, it is impossible to satisfactorily eliminate two coefficients at one time. At least three are required.

Therefore, even with the Toumazou article's repetitive claim of disclosing a second-order compensated bandgap reference, and with its claim of outstanding performance, it has been proved by the Applicant through the foregoing derivation that, with its two V_{BE}, or two signal generators, structure, Toumazou actually teaches no more than a conventional first-order compensated bandgap reference circuit.

Since it has been proved that what is taught by Toumazou is actually a first-order compensated bandgap reference, it is now more than clear that Toumazou describes no more than those conventional implementation such as Calafato et al, and the Applicant respectfully requests reconsideration by the Examiner of the adequacy of the underlying rejection.

Now the Applicant would like to turn to the discussion of the adequacy of citing In re Boesch in support of the rejection of the present application. In doing so, the Examiner specifically quoted that where the general conditions of the claim are disclosed in the cited and applied prior art, "discovery of an optimum value of a result effective variable in a known process is ordinarily within the skill of the art." Id. at 276.

The Applicant observes that In re Boesch discusses the obviousness of a patent application disclosing and certain type of claiming nickel base alloys and their composition. In Boesch, the Court of Appeals noted that "[e]ach of the ranges of constituents in appellants' claimed alloys overlaps ranges disclosed by Pohlman et al. and Lamb." Id. at 275, and after a lengthy discussion, the Court then reasoned that "[c]onsidering, also, that the composition requirements of the claims and the cited reference overlap, we agree with the Solicitor that the prior art would have suggested "the kind of experimentation necessary to achieve the claimed composition, including the proportional balancing described by appellants' N v equation." This accords with the rule that discovery of an optimum value of a result effective variable in a known process is ordinarily within the skill of the art." Id. at 276. And, as a result, the Court concluded that "a prima facie case of obviousness has been established." Id. Therefore, the Applicant stands the position that the situation in Boesch differs from the situation here in that, in Boesch the Court maintains the belief that discovery of optimum value is within the skill of the art ONLY because the composition requirements of the claims and those of the two cited reference overlap, whereas here in the case of the present application, the cited reference Toumazou article, upon showing, never teaches anything more than an ordinary first-order compensated bandgap reference, while in the claims of the present application a limitation of N being at least 2 is incorporated, and in the specification a systematic and expandable method of constructing an Nth-order compensated bandgap reference taught. It is then the Applicant's belief that it is far from adequate in asserting the underlying rejection, referencing In re Boesch.

Consequently, in view of the mischaracterization, as shown, in the Toumazou article, the Applicant respectfully requests withdrawal of the underlying rejection

against the previously presented claims 4, 14, and 21, and therefore requests allowance of all the currently pending claims to be granted.

New Claims

Claims 22-27 are newly added, which are dependent upon the previously presented independent claim 21. No new matter is entered. In particular, new claims 22-27 are formed according to the limitations claimed in original claims 5, 6, 7, 8, 9, and 10, respectively. Concerning the patentability of claims 22-27, applicant asserts that because they are dependent upon claim 21, they should be allowable for at least the same reasons as stated above for claim 21. Consideration of new claims 22-27 is respectfully requested.

Sincerely yours,

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Note: Please leave a message in my voice mail if you need to talk to me. (The time in D.C. is 12 hours behind the Taiwan time, i.e. 9 AM in D.C. = 9 PM in Taiwan.)